



NDCEE

National Defense Center for Energy and Environment

2008 ANNUAL REPORT



Technology Transition—Supporting DoD Readiness, Sustainability, and the Warfighter

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 2008		2. REPORT TYPE		3. DATES COVERED 00-00-2008 to 00-00-2008	
4. TITLE AND SUBTITLE National Defense Center for Energy and Environment 2008 Annual Report				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) National Defense Center for Energy and Environment (NDCEE), Concurrent Technologies Corporation, 100 CTC Drive, Johnstown, PA, 15904				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 20	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



**DoD Executive Agent
Office of the
Assistant Secretary
of the Army (Installations
and Environment)**

NATIONAL DEFENSE CENTER FOR ENERGY AND ENVIRONMENT

The NDCEE was established in 1991 with the directive to serve as a national leadership organization to address high-priority environmental, safety, and occupational health (ESOH) problems for the Department of Defense (DoD), other government organizations, and the industrial community.

The NDCEE's mission is to support DoD sustainability and readiness through:

- Applied research and development, where appropriate, to accelerate the transition of new technologies
- Demonstration and transition of environmentally acceptable materials and processes to defense industrial activities and private industry
- Training that supports the use of new, environmentally acceptable technologies

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Cover - Stryker, U.S. Army. Page 10 - Computer generated house graphic, Luckett & Farley. Page 11 - Lake City Army Ammunition Plant, U.S. Army. Page 17 - VPP, U.S. Navy. Page 19 - Helicopter, U.S. Navy.

A MESSAGE FROM THE EXECUTIVE AGENT



"The NDCEE is a valuable resource, not only to the DoD, but to the other federal agencies. In 2008, the NDCEE brought to bear the necessary resources to assist the DoD in identifying, researching, demonstrating, and validating emerging and existing technologies that address ESOH capability gaps and requirements. The NDCEE bridged several of the identified ESOH capability gaps by addressing sustainability across the broad spectrum of operations, installation management, training, and acquisition programs. Additionally, the NDCEE assisted the DoD by providing military installations with

reliable, sustainable, cost-effective solutions to plan, build, and modernize facilities and homes; by enhancing mission readiness through training, tools, and technologies that improve the health and safety of the warfighter; and by extending the life and improving the performance of weapons systems through innovative, sustainable technology solutions. Bottom line is that the NDCEE provides the tools to help DoD directly impact quality of life issues for our military personnel and their families, while at the same time improving the readiness of the Force by achieving performance advantages and enhancing efficiencies and cost effectiveness of the core enterprises of the military departments."

– Tad Davis, Deputy Assistant Secretary of the Army
for Environment, Safety, and Occupational Health, and Department of Defense
Executive Agent for the National Defense Center for Energy and Environment

A MESSAGE FROM THE PROGRAM DIRECTOR



"The NDCEE has demonstrated that it is a force multiplier that can bring the necessary resources to the DoD to address Service-specific or joint problem areas associated with the operational force, installation management, training, and acquisition programs. The NDCEE identifies technologies that address installation, environmental, safety, and occupational health issues. Additionally, by demonstrating and validating the applicability of these technologies, the NDCEE provides recommended solutions to multiple user needs and validated requirements. The NDCEE is working collaboratively with

the DoD to standardize a process to transfer/transition these validated technologies – not only within the DoD but to other federal agencies and the industrial base. In Fiscal Year 2008 (FY08), the NDCEE successfully transitioned 12 technologies to 24 client sites or DoD entities. In support of the DoD readiness, sustainability, and warfighter mission, the NDCEE served 85 client and stakeholder organizations in FY08, and ended the fiscal year with an increase of \$44.4 million on contract."

– Hershell E. Wolfe (Hew), Principal Assistant to the Deputy Assistant Secretary of the Army
(Environment, Safety, and Occupational Health), and Department of Defense
Program Director for the National Defense Center for Energy and Environment

SUPPORTING DoD READINESS, SUSTAINABILITY, AND THE WARFIGHTER

Our mission is to research, demonstrate, and support the fielding of viable, mission-driven solutions that reduce total ownership costs and address priority ESOH challenges impacting installations, weapons systems, operations, and the warfighter.

In FY08, the National Defense Center for Environmental Excellence was redesignated as the National Defense Center for Energy and Environment. As such, the NDCEE continues to play a vital and expanding role in support of DoD and other government organizations in addressing the strategic interdependence of environmental and energy technology requirements within an overall sustainability framework. Dozens of projects are underway at any one time as clients look to us for cost effective, leading-edge solutions to diverse technology challenges.

PUTTING SUSTAINABILITY PRINCIPLES INTO PRACTICE TO PLAN, BUILD, AND MODERNIZE INSTALLATIONS

In FY08, the NDCEE supported several strategic energy and sustainability planning initiatives, such as the development of the Army's Energy Security Strategy/Strategic Plan. The NDCEE also continued to play a lead role in assisting DoD sites with Installation Sustainability Planning (ISP), supporting seven Army and National Guard sites in FY08 as well as regional sustainability planning for DoD installations in Hawaii. Several other projects of the past year highlight our support of sustainable installations and infrastructure, including our ongoing investigation of straw bale buildings and zero energy housing strategies and technologies. The NDCEE also is playing a key role in the modernization of critical industrial base assets — in this case, Army Ammunition Plants (AAPs) — and providing recommendations on appropriate facility size, location, and equipment for two new corrosion repair facilities to support the relocation of personnel and materiel from Okinawa to Guam. Through these and other projects, the NDCEE is truly putting sustainability principles into practice to plan, build, and modernize installations and infrastructure.

INTEGRATING ESOH INTO THE ACQUISITION LIFE CYCLE AND IMPROVING WEAPONS SYSTEM MAINTENANCE AND PERFORMANCE

Integrated with our support of installation sustainability objectives, the NDCEE is supporting the acquisition life cycle, including procurement of environmentally preferred products, logistics and supply chain issues, and evaluation of environmentally acceptable alternative solutions as applied to

“Thanks to their in-depth knowledge of sustainability across the Army and their ability to impart that knowledge in a way that makes it meaningful to each installation, your staff has enabled us to move forward at a significant pace. Their teamwork and enthusiasm for Army Sustainability inspires others to work together and to excel.”

— COL Judith D. Robinson,
Garrison Commander,
Fort Detrick, MD

weapons system maintenance and performance. For example, in support of the Federal BioPreferred Program, the NDCEE is conducting both assessments and demonstration/validations of biobased products in various categories for the Defense Logistics Agency (DLA) and developing life-cycle inventories for the National Institute of Standards and Technology (NIST). Two technologies demonstrated by the NDCEE, X-ray fluorescence spectrometry and a Lead-Free Surveillance and Analysis System, may have a significant impact on safety and readiness as they help depots such as Tobyhanna Army Depot manage the integration of lead-free materials into the DoD supply chain. Numerous weapons system production, maintenance, and reset/recap issues were addressed in FY08, encompassing challenges ranging from coatings removal from delicate substrates or prior to nondestructive testing of welded parts to identifying alternatives to mitigate corrosion on the steel penetrator of 5.56mm green ammunition. NDCEE developed, demonstrated, validated, and fielded technologies and improvements will ultimately offer the warfighter increased performance at a reduced or competitive cost and be implemented to meet the increasing maintenance throughput and/or production levels required to maintain mission readiness.

ENHANCING OPERATIONAL CAPABILITIES AND REDUCING HEALTH AND SAFETY RISKS THROUGH INNOVATIVE TOOLS, TRAINING, AND TECHNOLOGIES

Warfighter well-being and the health and safety of military workplaces are critically important to the DoD. The NDCEE works hand-in-hand with the DoD to address ESOH issues by providing tools, training, and technologies for the warfighter and for those who stand behind the warfighter.

The NDCEE supports training of many types in many venues. For example, we conducted hands-on weapons training in theatre to promote the use of nonlethal weapons and enhance operational capability in Iraq. At Fort Sam Houston, we demonstrated/validated and transitioned an automated foot assessor to improve selection of athletic footwear for soldiers and reduce overuse injuries in basic training.

The NDCEE's continued support to two key DoD safety programs, the Voluntary Protection Programs Center of Excellence (VPP CX) and Defense Safety Oversight Council (DSOC), also resulted in FY08 successes. With the support of the VPP CX, two DoD organizations joined the ranks of the VPP elite during 2008: Naval Air Station (NAS) Key West, FL, and Marine Corps Logistics Base (MCLB) Barstow, CA. Example DSOC initiatives include the development of a Web-based interface called Medevac to track non-battle injuries (NBIs) and provide the DoD with the ability to identify Service-specific causes of injury—a critical element of each Service's injury prevention program. The NDCEE also demonstrated the Noise Exposure and Acquisition Tool (NEAT), an Excel-based model to help the DoD acquisition program managers justify engineering controls that will prevent hearing loss. These are just a few of the many projects in which we are investigating and implementing tools and technologies to reduce preventable mishaps and enhance warfighter safety and well-being.

July 24, 2008: AMCOM issues a re-write of previous AED A1116C as Maintenance Engineering Order AED A1116D, including the option to use starch graft acrylic polymer blast media (MIL-P-85891A, Type VII) - a corn hybrid polymer blasting media demonstrated by the NDCEE at Corpus Christi Army Depot - on airframe structures and components.

“DoD sites implementing VPP have seen significant reductions in injury rates and lost work days, which translates to increased readiness and more dollars for the warfighter.”

— Joseph J. Angello, Jr.,
Executive Secretary, Defense
Safety Oversight Council

FY08 TECHNOLOGY TRANSITIONS

Since its inception, the NDCEE has provided technology assessment, development, demonstration, validation, implementation, and other technical services to a wide variety of DoD and other government organizations, DoD contractors, and other industry organizations. In FY08, the NDCEE conducted assessment, demonstration/validation, and transition activities for 58 technologies. While many projects span one or more fiscal years, in FY08 the NDCEE transitioned 12 technologies to 24 sites.



Automated Foot Assessor – Transitioned to Fort Sam Houston, TX, and the Army War College, Carlisle Barracks, PA



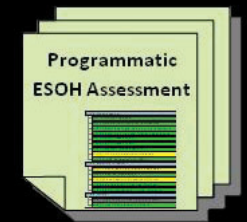
Bullet Catcher (STAPP) – Transitioned to Massachusetts Military Reservation, MA



Compost Monitoring Process – Transitioned to Fort Lewis, WA



Daylighting Technologies – Transitioned to Fort Bragg, NC



ESOH Programmatic Risk Tool – Transitioned to Army Learning Management System; Joint Forces Command Learning Management System, Navy Learning Management System, and Defense Logistics Agency Learning Management System



Magnetic Unexploded Ordnance (UXO) Recovery System (MURS) – Transitioned to New Boston Air Station, NH



RIPPLE Software – Transitioned to Kaneohe Bay, HI and Camp Pendleton, CA (Training Support Division and 1 Marine Expeditionary Force)



UXO Electronic Data Collection Tool – Transitioned to White Sands Missile Range, NM



X-Ray Fluorescence (XRF) for Lead Detection – Transitioned to Tobyhanna Army Depot, PA



Water-Dispersible Chemical Agent Resistant Coating (WD-CARC) – Transitioned to Fort Stewart, GA and Fort Benning, GA



WD-CARC Drying Technology – Transitioned to Camp Dodge, IA; Combined Support Maintenance Shop (CSMS), Army National Guard Facility, Eastover, SC; Camp Douglas, WI; Jefferson City, MO; Fort McCoy, WI; and CSMS, Fort Indiantown Gap, PA



OPERATIONAL STATISTICS

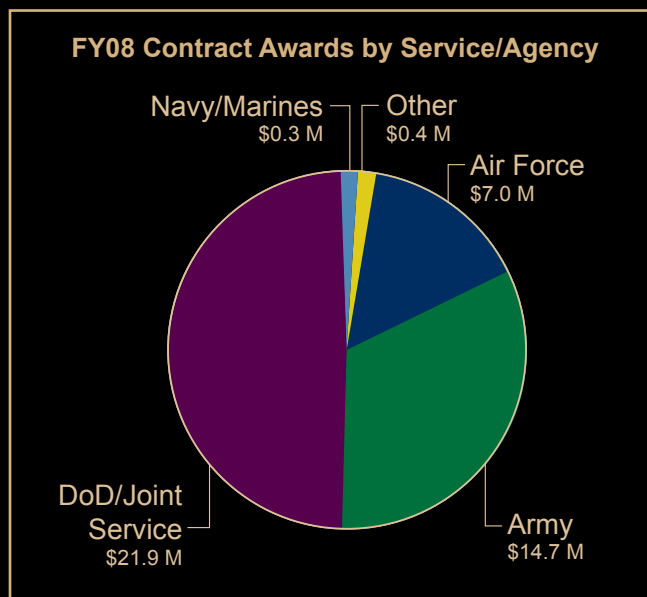
In FY08 the NDCEE continued the critical mission that it began in 1991: identifying, demonstrating, evaluating, and fielding technologies in support of DoD readiness, sustainability, and the warfighter. In support of this mission, the NDCEE served 85 client and stakeholder organizations in FY08, and total dollars on contract increased by \$44.4 million.

The NDCEE initiated 35 new task orders, completed 25, and ended FY08 with 147 task orders and \$173 million in contracts, thanks in part to many returning reimbursable clients. As shown in the graph “FY08 Contract Awards by Service/Agency,” the NDCEE performs work across the DoD and DoD agencies and supports other federal agencies. The NDCEE averaged 123 client deliverables per month, almost a 50 percent increase from FY07. Average on-time delivery was 98 percent. The NDCEE is required to disseminate deliverables to appropriate DoD organizations to ensure information sharing among applicable U.S. Government agencies and private industry, and in FY08, 244 deliverables were uploaded to the Defense Technology Information Center (DTIC) to make this information available.

In addition to serving a diverse client base, the NDCEE strives to achieve diversity with regard to subcontracting, especially in compliance with Public Law 95-507 that encourages the use of small and disadvantaged businesses in federal contracting. In support of these socioeconomic goals, to date, 60 percent of subcontracting dollars have been to small businesses, including small disadvantaged business and women-owned small businesses.

OUTREACH ACTIVITIES

For 17 years, the NDCEE has been fostering new ideas and extending the base of knowledge with regard to energy and ESOH issues. Transferring that knowledge is an important part of the NDCEE’s role, and in FY08 that was accomplished through a variety of outreach efforts. For example, the architecture and contents of the NDCEE Web site were updated to better crosswalk projects and technologies. Bi-annual NDCEE Program Reviews took place in November 2007 and June 2008 in Washington, DC, giving stakeholders from across the DoD the opportunity to learn, share, and network. Attendees’ survey comments such as the following told the story: “Good networking. Nice to know that technology initiatives are alive and well.” and “Helps to provide this opportunity; great information sharing and networking opportunity.” In addition to the Program Reviews, the NDCEE hosted a Sustainability Information Exchange in Washington, DC, June 9 and 10, 2008.



The NDCEE is working across the U.S. Army, Navy, Air Force, Marines, Department of Defense, and other federal agencies. This chart shows the percentage of FY08 contract awards supporting each client.



Fact Sheet

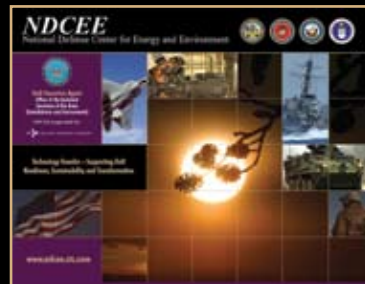


Exhibit Booth



Newsletter

NDCEE subject matter experts regularly contribute to military and technical publications and attend a variety of national conferences where they host informational booths, display poster presentations, and deliver presentations. Conference highlights in FY08 included the technology demonstrations that took place at the NDCEE booth at the Association of the U.S. Army (AUSA) annual meeting and our active involvement in the Joint Services Environmental Management (JSEM) Training Conference & Exposition. The NDCEE gave 24 presentations at JSEM, five staff members served as session chairs, and four technologies were featured at the NDCEE booth.

In addition to this annual report, the NDCEE produced 10 other publications in FY08 to disseminate information to specific audiences. These included a Technologies Publication, Capabilities Summary, several newsletters, fact sheets, and task descriptions—many of which are available at <http://www.ndcee.ctc.com/>.

This annual report provides highlights of several NDCEE projects that encompass many of our capabilities and services. The NDCEE is committed to delivering quality solutions to address clients’ mission-critical requirements and we invite and encourage you to take advantage of our offer – How Can We Support Your Mission?

PROVIDING MILITARY INSTALLATIONS WITH RELIABLE, SUSTAINABLE, COST-EFFECTIVE SOLUTIONS TO PLAN, BUILD, AND MODERNIZE FACILITIES AND HOUSING



The NDCEE is providing planning, logistics, and technical support to the U.S. Marine Corps (USMC) Corrosion Prevention and Control Program for the design, construction, and equipping of two new corrosion repair facilities critical to preparations for the relocation of military forces and assets from Okinawa to Guam.

The DoD has pledged “sustained vigilance in attaining a quality of life for our service men and women and their families that matches the quality of their service to our nation.” The quality, affordability, and environmental stewardship of the places where members of our armed forces live, train, and work—our installations—is a high priority.

To respond to these challenges, in FY08 the NDCEE supported strategic planning initiatives, such as the Army Energy Security Task Force and their development of the Army’s Energy Security Strategy/Strategic Plan. This Strategy/Plan provides recommendations and several specific action items to highlight the types of projects that exemplify the Army’s new approach to energy planning, investments, and operations, many of which will have far-reaching impacts on installation sustainability. The NDCEE also continues to play a lead role in assisting DoD sites with ISP. In addition, demonstration of design techniques and technologies for sustainable construction and facility modernization make efficient use of resources while minimizing adverse impacts on the environment, which helps military installations meet their sustainability goals and ensure the well-being of our service members and families.

PLANNING SUSTAINABLE INSTALLATIONS

New approaches are needed to meet the challenges of the future, and the NDCEE’s approach to ISP is providing military installations with successful plans that integrate long-term sustainability goals with their existing strategic initiatives and operationalize their strategic sustainability initiatives through existing management systems.

The NDCEE began this effort with the Army, and has successfully leveraged the new sustainability planning model for use at other types of installations, such as those of the National Guard. In FY08, the NDCEE worked with the following organizations to develop their individual integrated Installation Sustainability Plans: U.S. Army Garrison Hawaii, Letterkenny Army Depot, Fort Detrick, Radford Army Ammunition Plant, Pennsylvania National Guard, California National Guard, and Minnesota National Guard.

STRAW BALE BUILDING PLANS: A MILITARY FIRST

An important part of the planning process is securing adequate funding for construction activities, and the NDCEE is helping Fort Hood to roadmap that process. It is anticipated that these roadmaps will be useful to other military installations seeking grants from government, foundations, and other agencies or organizations. To

streamline the grant process, the NDCEE is devising grant application templates as well as templates for strategic plans, execution plans, and performance measurement systems.

Fort Hood is specifically interested in acquiring funding for straw bale buildings and, with the NDCEE’s help, plans to construct the first such building on a military installation. Straw is a renewable resource that acts as excellent insulation and has a number of advantages over conventional building materials. Lower cost, ease of construction, and zero waste are among the anticipated initial benefits.

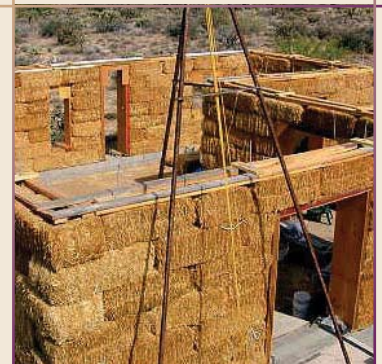
SUSTAINABLE BUILDING DESIGN AND CONSTRUCTION

The NDCEE is assisting the DoD in identifying and evaluating solutions for sustainable construction on military posts, including Leadership in Energy and Environmental Design (LEED®) standards as applied to a military campus, zero-energy housing (ZEH) concepts, and cost-effective worker-beneficial lighting technologies.

Helping the DoD Meet LEED Building Standards

The LEED® Green Building Rating System is the nationally accepted benchmark for the design, construction, and operation of high-performance green buildings. The NDCEE, tasked to evaluate the applicability of the LEED-New Construction (LEED-NC) and LEED-Neighborhood Development (LEED-ND) programs at military bases, has concluded that certification at the silver rating level is attainable. While some elements of LEED conflict with the unique nature of military installations (e.g. force protection and other security requirements), this can be counter-balanced with points for access to green spaces or restoring habitat. Based on case studies conducted at Fort Belvoir, VA and Fort Campbell, KY, the NDCEE has successfully demonstrated that LEED-NC and LEED-ND can be used to guide future military housing construction.

Fort Hood plans to construct the first straw bale building on a military installation with the NDCEE’s support. Straw is a renewable resource with a number of advantages over conventional building materials.





Applying ZEH design concepts that incorporate synergies between architecture and mechanical/electrical systems, the roof of this house was redesigned to provide additional space for photovoltaics.

Optimizing ZEH Technologies

The NDCEE is assisting with the design and evaluating the performance of ZEH for DoD installations. Innovative design and technologies allow these houses to be “independent” from the utility grid by generating electricity using on-site renewable energy sources—enhancing both energy security and the well-being of military families. The NDCEE is assessing the energy, economic, and environmental performance of the ZEH versus that of standard military housing.

As part of an Environmental Security Technology Certification Program (ESTCP) project, the NDCEE is working with Fort Campbell, Army Installation Management Command Southeast, Fort Campbell Family Housing, Actus Lend Lease, and the National Association of Home Builders Research Center, to identify and evaluate ZEH strategies and technologies for duplexes being built at Fort Campbell, KY.

NDCEE engineers determined the expected energy use of the duplexes at Fort Campbell by evaluating the energy requirements for such items as heating, cooling, lighting, and appliances. This same information was determined for a proposed ZEH design that incorporates synergies between architecture and mechanical/electrical systems, photovoltaics in the roof, and more. The design team was able to reduce the anticipated energy use by more than 50 percent by applying ZEH design technologies and strategies.

As the project moves to the construction phase, the NDCEE will monitor and verify construction costs, energy consumption, use patterns, and on-site energy production. Ultimately, lessons learned will be incorporated into more than 38,000 military housing units and 4,900 hotel rooms that Actus Lend Lease is building nationwide.

Using Daylighting Technologies to Improve the Work Environment

In another energy-related project, the NDCEE investigated daylighting systems, which use sunlight to illuminate building interiors while improving the quality of the work environment. The NDCEE teamed with Fort Bragg, NC, where lighting costs are an estimated \$3.9 million annually, to determine if daylighting alternatives are effective in offsetting existing electricity requirements.

The NDCEE evaluated three daylighting technologies from different manufacturers. The demonstration/validation at Fort Bragg showed that while initial costs of the technologies are relatively high, each type showed significant energy reductions—especially when combined with the use of low-cost occupancy sensor controls. Additionally, surveys conducted before and after the installation of the daylighting systems showed that workers prefer the soft, natural light of daylighting systems, which may lead to increased worker satisfaction. Upon completion of the study, Fort Bragg decided to keep the daylighting systems for further, longer-term evaluation.

INDUSTRIAL-BASED MODERNIZATION

New demands to supply warfighter needs at military installations must be met with innovative solutions not just to plan and construct new buildings, but to modernize existing buildings. The NDCEE is working with several DoD sites on a variety of modernization efforts.

For example, the NDCEE is supporting modernization of Lake City Army Ammunition Plant (LCAAP), MO, the world’s largest manufacturer of small arms ammunition. Due to the high cost of off-site disposal for hazardous wastes containing explosive residues, lead, and mercury, and the need to process explosive wastes on site to reduce storage requirements for these hazardous wastes, LCAAP has implemented major modifications to its explosive waste incinerator. Because these changes affect the gas emission and visible stack plume, new permit applications have been submitted to the State of

The dome, mirror, and tracking mechanism of a daylighting system is mounted on the roof of a building at Fort Bragg, NC. A solar cell powers the tracking mechanism that controls the mirrors to optimize the sunlight transmitted to the lobby below.





Upgrading the hazardous waste incinerator at LCAAP will improve the U.S. Army's capability to supply high-quality small arms ammunition to the warfighter. LCAAP's 5.56 mm production lines, like the one shown here, produce more 5.56 mm rounds than any other facility in the world.

Missouri. The NDCEE supported the incinerator permit application process and reviewed the results of the trial burn so that LCAAP can maintain its capability for on-site disposal of ammunition-related wastes. In turn, the incinerator upgrade is expected to improve the Army's continuing capability to supply reliable quantities of high-quality small-arms ammunition to the warfighter.

Another example of the NDCEE's support of modernization efforts at military installations is the work being performed for Milan and Iowa AAPs. The NDCEE is supporting the Program Executive Office – Ammunition (PEO-Ammo) and Joint Munitions Command team with the acquisition process for Milan and Iowa AAPs, focusing on joint/alternative use of the facilities while improving the Army's ammunition procurement flexibilities and incorporating technology which allows AAPs to be more competitive into the next generation. The NDCEE is part of an Integrated Product Team that is identifying and verifying options and recommendations for the Army so that strategic and sustainability goals will be met at minimal risk and cost.

The same approach that the NDCEE initiated for Milan and Iowa AAP modernization support will be applied to Radford AAP in FY09.



This NDCEE rendering is for the new USMC CPAC Program in Guam. The NDCEE is recommending land and infrastructure requirements to help ensure the successful relocation of the CPAC from Okinawa to Guam.

RELOCATING INSTALLATIONS EFFICIENTLY AND EFFECTIVELY

The USMC is relocating personnel and materiel from Okinawa to Guam, and the NDCEE is providing planning, logistics, and technical support to reduce the impact of corrosion on post-transition readiness. The relocation is complicated, and selecting the best facility and equipment for the efficient operation of the new installation in Guam while reducing costs for the DoD are important aspects of the task.

The USMC Corrosion Prevention and Control (CPAC) Program conducts corrosion monitoring, prevention, and repair operations on Okinawa. During the transition, the CPAC Program must maintain its current level of corrosion mitigation while effectively transferring operations to two new corrosion repair facilities (CRFs). To ensure a successful transition and reduce the impact of corrosion on USMC readiness, the NDCEE is providing recommendations on appropriate facility size, location, and equipment. Recommendations and transition planning must minimize the impact of corrosion during shipping of assets from one site to another and mitigate any interruption of CPAC services during the transition.

The NDCEE has established lines of communication among agencies involved in the transition and visited CRFs at Camp Lejeune, NC; Camp Pendleton, CA; Marine Corps Base Hawaii, Kaneohe Bay, HI; and Camp Kinser, Okinawa. Baseline conditions have been documented, potential flow requirements for the new CRFs have been evaluated, and a preliminary design of the new CRF has been developed (See architectural drawing.)

As the project moves forward, the team will develop recommendations for the land requirements, infrastructure, and resources that are required to support CRF capabilities on Guam and Okinawa.

"The NDCEE is a huge help to us and doing an excellent job. Thanks for all you do. Your planning will go a long way toward getting state-of-the-art facilities at Guam and Hansen. The effect of the work we do now will be felt for many years to come."

– William P. Antell,
Branch Head, CRF

INTEGRATING ESOH INTO THE ACQUISITION LIFE CYCLE AND IMPROVING WEAPONS SYSTEMS MAINTENANCE AND PERFORMANCE THROUGH INNOVATIVE, SUSTAINABLE TECHNOLOGY SOLUTIONS



Lead-free solder in electronic components can cause failure in critical weapons systems. The NDCEE has transitioned XRF technology to Tobyhanna Army Depot that can scan electronic components to determine if they contain the specified lead content, thus reducing the risk of weapons system failure and protecting the warfighter.

From the detection of lead-free components for weapon systems to biopreferred purchasing, the NDCEE applies life-cycle thinking to evaluate the sustainability of technology and strategy options. We facilitate a shift to life-cycle thinking throughout the supply chain at every level of operations and throughout every applicable project.

For example, the NDCEE is demonstrating, validating, and fielding technologies, processes, and methodologies in a joint environment to increase weapons system performance, safety, and joint-readiness in response to lead-free electronic components infiltrating the DoD supply chain. While lead-free solder addresses environmental and occupational health issues, it has been implicated in the formation of tin whiskers that have caused weapon systems to short circuit and fail. The failure of DoD weapons systems has a direct negative effect upon readiness, warfighter support, and human health and safety. Currently there are no requirements for electronic component manufacturers to change their labeling to differentiate between traditionally processed devices and those processed using lead-free technologies. The NDCEE is addressing the lead-free issue within the DoD through two related projects that will help manage the integration of lead-free materials into the DoD supply chain.

The NDCEE transitioned XRF spectrometer technology to Tobyhanna Army Depot (TYAD) in FY08 after a successful technology demonstration. TYAD is the DoD's primary facility for repair, maintenance, and total life-cycle support for communications and electronics equipment and systems used on the battlefield.

At TYAD, the NDCEE demonstrated and validated that the XRF Spectrometer can be used to determine if electronic components were produced using traditional or lead-free processes. The NDCEE demonstration showed that ~30 percent of unique items scanned were lead-free.

The NDCEE also developed a database—the Lead-Free Surveillance and Analysis System (LSAS)—to provide access to reliable information on lead-free data for the DoD and its contractors. The LSAS is a Web application that helps users understand and share information to assess the true nature of the lead-free problem within DoD's supply chain so that it can be managed and risks can be mitigated.

A built-in search engine permits LSAS users to view individual scan records and export search results to an Excel® spreadsheet. Information about new electronic pieces, including the manufacturer's name, Commercial and Government Entity (CAGE) Code, and roll-up percentage value of parts found to be lead-free, is easily accessed through the LSAS. Users can also find the



XRF technology, transitioned to Tobyhanna Army Depot after a successful NDCEE demonstration, helps the DoD manage lead-free components and materials in its supply chain.

number of parts scanned using a measurement tool, such as XRF technology, and the number of items confirmed to be lead-free. The database also contains information regarding the elemental composition and thickness of component finishes, and selected users have access to data provided by the Federal Logistics Information System (FLIS) without having to use sources outside of the LSAS.

IMPROVING BIOPREFERRED PURCHASING

The NDCEE is committed to identifying new, sustainable solutions for clients. Another way in which we deliver on that commitment is through our support of the Federal BioPreferred Program (BioPreferred), which requires all federal agencies to establish a preferred procurement program for biobased products.

The U.S. Department of Agriculture (USDA), which developed BioPreferred, is designating product categories for preferred procurement of biobased products. To meet the requirements of BioPreferred, the Defense Supply Center Richmond (DSCR) is evaluating biobased alternatives for product categories managed by DSCR and identified by USDA for preferred procurement.

The NDCEE is supporting DSCR by comparing and evaluating performance data for biobased products in product categories designated under BioPreferred. The NDCEE evaluates performance against existing government requirements. Through this project, the NDCEE also provides participating vendors with an analysis that shows how their results compare with the government performance requirements.

For example, the NDCEE has completed an initial assessment of biobased hydraulic fluids for use in military tactical equipment. After three rounds of laboratory testing, none of the tested fluids passed all of the government-specified requirements. It is anticipated that vendors will use the analyses provided to them to

focus efforts for improving their products. The NDCEE has completed similar analyses for biobased penetrating lubricants and diesel fuel additives and is currently evaluating seven additional biobased product categories designated by USDA. These range from biobased metal working fluids and glass cleaners to biobased greases and firearm lubricants. The NDCEE is also developing a Biobased Product Evaluation Database capable of compiling and organizing biobased product data from numerous product categories and comparing this data to government specifications.

At the same time, the NDCEE is developing environmental profiles known as life-cycle inventories (LCIs) for the NIST in support of life-cycle assessments (LCAs) that can help federal procurement officers make more informed decisions when considering biobased products. The Building for Environmental and Economic Stability (BEES) tool, which was developed by the NIST, is being used by the USDA to evaluate the life-cycle environmental impact and cost of biobased products that are part of BioPreferred.

The BEES tool measures the environmental performance of biobased products using the LCA approach specified in the ISO 14040 series of international standards. All stages in the life cycle of a product are analyzed, including raw material acquisition, manufacture, transportation, installation, use, and waste management (e.g., reuse, recycle, or disposal). The LCA approach provides actual data that characterizes the life-cycle environmental impact of a product. Products perceived as environmentally friendly may not be when all life-cycle stages are considered.

The NDCEE, working with manufacturers, has developed 58 LCIs for biobased products during FY08. Each LCI takes into account all of the material and energy inputs as well as the environmental releases from producing, using, and retiring a specific product. As the information is incorporated into BEES, the federal procurement community can evaluate the cost and environmental impacts of the products that they buy, addressing the total cost of acquisition and ownership of a system over its full life.

REMOVING COATINGS WITH BIOBASED MATERIALS

Corn-hybrid polymer (CHP) blasting is a dry, abrasive blasting process that utilizes crystallized cornstarch—an organic, nontoxic, biodegradable material. This environmentally friendly medium is most applicable to delicate substrates where hand sanding and chemical wiping are used. CHP media meet military specification

MIL-P-85891 for Type VII plastic media. Because of NDCEE and other successful DoD demonstrations, the CHP process has been implemented as an alternative coatings removal process by the U.S. Coast Guard, Navy, and U.S. Air Force (USAF) for use on aircraft components that are comprised of composite materials and other delicate substrates.

NDCEE evaluations have confirmed that the CHP coatings removal process offers significant advantages over other removal techniques. The technology is user friendly, can be recycled between five to 10 times before spent, meets or exceeds current removal rates, and meets or reduces current process costs. Based on an NDCEE cost-benefit analysis on four UH-60 Blackhawk components, Corpus Christi Army Depot (CCAD), TX, could achieve a cost savings of more than \$1 million annually by switching from hand sanding to CHP blasting.

In FY08, as the result of a successful NDCEE CHP demonstration at CCAD, a Maintenance Engineering Order (MEO) was issued that allows CCAD to use CHP blasting for airframe maintenance. CCAD is the largest helicopter repair, overhaul, and maintenance facility in the world. It overhauls, repairs, modifies, retrofits, tests, and modernizes helicopters, engines, and components for all DoD services and is responsible for preparing aircraft for overseas shipment. While the MEO is specific to CCAD, other Army airframe maintenance depots can use CHP provided that it is authorized by the on-site liaison engineer. As a result of the NDCEE's demonstration at CCAD, the Mississippi National Guard Aviation Classification and Repair Depot (AVCRAD) is in the process of implementing CHP.



Based on participants' comments and results from the NDCEE demonstration, RDECOM's Aviation Engineering Directorate released an MEO on July 24, 2008, that allows CCAD to use CHP on aviation airframes. Photo shows a CCAD blaster using the CHP technology on a UH-60 Blackhawk rotor blade cuff.

PROVIDING A COATING PROCESS FOR GREEN AMMO

Green ammunition reduces the environmental impact of Army ammunition, while offering increased performance and lethality. While the new green ammunition design—which now consists of a lead-free slug, copper jacket, and steel penetrator—eliminates many environmentally hazardous materials, it exposes the steel penetrator to manufacturing forces that may damage the coating and make it vulnerable to corrosion.

Corrosion of the steel penetrator may diminish projectile performance and decrease warfighter confidence. This is unacceptable, and the NDCEE has been working as an integral part of the Army's Integrated Product Team to select and implement a new coating process for 5.56mm green ammunition that surpasses all defined requirements. It must be capable of protecting the steel penetrator from corrosion and compatible with manufacturing processes at LCAAP. The NDCEE has evaluated two coatings that have far exceeded the requirements set forth by the government, which included achieving a 1 mil coating thickness on all surfaces of the penetrator, maintaining a Hardness Rockwell "C" value between 55-60 after all coating operations, costing less than \$0.01/round when in full scale production, and withstanding 48 hour salt spray testing with less than 10% visible red rust on the penetrator. One coating resisted corrosion for up to 9 days in the salt spray chamber and costs only \$0.005/round, while another coating met the corrosion resistance requirement and only costs \$0.002/round.

Once coatings passed the initial testing criteria described above, they were subjected to a more rigorous salt spray requirement. The corroded cartridges were then fired through three different weapons systems. A coating is considered a failure if any of the weapons systems fail to perform and jam as a direct result of corrosion on the penetrator. To date, none of the NDCEE-suggested coatings have caused any weapon malfunctions during testing.

PUTTING LASER TECHNOLOGY TO WORK FOR DOD WEAPON SYSTEMS

The NDCEE has been and continues to be involved in numerous programs with the USAF, Army, Navy, and Coast Guard to evaluate the use of lasers for maintenance and sustainment of DoD weapons systems. Areas of test, evaluation, design, and implementation have included the use of portable, low-power hand-held lasers as well as high-powered lasers integrated with robotic systems for coatings removal applications.

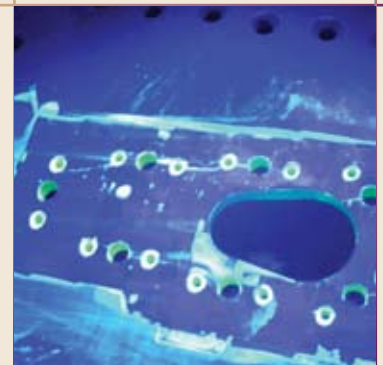
Various laser technologies are being investigated as replacements for current, environmentally-hazardous, solvent-based or abrasion-based coating removal processes. For example, in FY08, the NDCEE, working with the Navy Facilities Engineering Command to evaluate the effectiveness of a portable laser system for coating removal, conducted a demonstration/validation test at the Intermediate Maintenance Facility (IMF) and Strategic Weapons Facility Pacific (SWFPAC), Bangor, WA.

The 300-watt (W) Neodymium:Yttrium-Aluminum-Garnet (Nd:YAG) handheld laser system offers environmental, health, safety and cost benefits over current coating removal processes for nondestructive testing preparation of welded parts. The NDCEE demonstration/validation showed that the portable handheld laser can reduce hazardous waste generation a hundredfold as compared with alternative solutions. The laser produces only particulate dust, which can be captured in standard HEPA-filter exhaust devices. Furthermore, this system has a payback period of less than five years. This technology was recommended for implementation at IMF and SWFPAC.

EVALUATING ENVIRONMENTALLY BENIGN DEICING ALTERNATIVES

Deicing products ensure that aircraft and runways are free of ice that can lead to catastrophic failure. Currently, only products containing propylene glycol meet military specifications for deicing aircraft; however, propylene glycol has negative effects on the environment. In a project supporting the USAF, the NDCEE tested 10 materials found on military aircraft for compatibility with a baseline deicing fluid and an alternative, environmentally benign fluid. Finding an alternative that safely deices military aircraft without damaging materials, components, or systems and minimizes environmental effects will allow the USAF to meet its ESOH and sustainability goals.

Dye penetrant testing confirmed that a handheld Nd:YAG laser can be used to remove coatings for non-destructive testing prior to welding without damaging components.



ENHANCING MISSION READINESS THROUGH TRAINING, TOOLS, AND TECHNOLOGIES THAT IMPROVE THE HEALTH AND SAFETY OF THE WARFIGHTER



Battlefields are the classrooms when our employees conduct nonlethal weapons training for U.S. warfighters in Iraq. The Council on Foreign Relations has advised that nonlethal capabilities “could substantially improve U.S. effectiveness in conflict, post-conflict, and homeland defense.”

Many of our subject matter experts are military-trained and battlefield experienced. Along with our other dedicated NDCEE team members, they are outstanding assets in the war against terror and have provided incredible knowledge and mission-critical assistance in a variety of projects aimed at improving the health and safety of the warfighter. These projects cover a wide range of needs, beginning with nonlethal weapons training.

In 2004, the Council on Foreign Relations advised: “Wider integration of nonlethal weapons into the U.S. Army and Marine Corps could have reduced damage, saved lives, and helped to limit the widespread looting and sabotage that occurred after the cessation of major conflict in Iraq. Incorporating [nonlethal weapons] capabilities into the equipment, training, and doctrine of the armed services could substantially improve U.S. effectiveness in conflict, post-conflict, and homeland defense.” Subsequently, the NDCEE was tasked to support the United States Army Military Police School (USAMPS) Army Nonlethal Scalable Effects Center (ANSEC) to help address this concern.

In FY08, an exportable nonlethal training support package was developed, and the NDCEE conducted nonlethal weapons training in Iraq and other sites around the world and validated the training support package we helped create. With battlefields as their classrooms, NDCEE subject matter experts are teaching U.S. warfighters training modules that include the full gamut of nonlethal weapons systems—from Tasers® to vehicle arresting devices. Students and Commanders are providing very positive feedback on both course content and presentation.

ACHIEVING STAR RECOGNITION

Closer to home, the NDCEE is successfully working to help improve workplace health and safety at military installations and Defense agencies. The NDCEE operates the DoD VPP CX. Its mission is to help organizations attain Star recognition under the Occupational Safety and Health Administration’s (OSHA’s) VPP. Star recognition is the highest designation for workplaces with comprehensive, successful safety and health management systems, and some of our successes have earned national attention.

With the support of the NDCEE and the VPP CX, two DoD organizations joined the ranks of the VPP elite during 2008. On June 12, 2008, the VPP CX was recognized for helping NAS Key West, FL, attain VPP Star Status. The naval station had been among the lowest ranked federal workplaces and is now recognized as one of the best.

Accidents, for example, were reduced by 50 percent in the 2003-2004 timeframe as the station moved through VPP-inspired changes. Marine Corps Logistics Base (MCLB) Barstow, CA, was designated as a VPP Star site on July 10, 2008. Although MCLB Barstow has an entirely different mission, workforce culture, environment, and management than NAS Key West, a similar outcome was achieved by implementing VPP — a dramatic reduction in mishap rates by more than 90%. This is consistent with what is experienced in the private sector; VPP participants have seen a 70 percent reduction in injuries, 20 percent reduction in worker’s compensation costs, and a 150 percent return on investment.

In 2007, a total of 12 DoD organizations held this distinction of VPP Star status. By the end of 2008, there was a total of 16, and by the end of 2009, it is anticipated there will be 30 or more DoD organizations that have achieved VPP Star status. The NDCEE is proud to have a role in these successes, which enhance mission readiness across the DoD.



With the NDCEE's mentoring and support, NAS Key West, FL joined the elite VPP ranks as a Star worksite.



Lower-extremity injuries resulting from overuse and sports injuries comprise 80 percent of all military training-related injuries. Accurately identifying a service member's foot type and providing proper footwear can prevent many of these injuries. The NDCEE demonstrated and transitioned an Automated Foot Assessor to Fort Sam Houston and the Army War College, Carlisle Barracks.

REDUCING LOST DUTY DAYS

New technology is also vital in the ongoing commitment to warfighter health and safety, and the NDCEE has effectively demonstrated and validated an automated foot assessor that can improve selection of athletic footwear for soldiers and reduce overuse injuries. Overuse injuries in the lower extremities are listed as the leading cause of lost duty days across the DoD, affecting training and readiness. Matching running shoes to arch type can improve foot mechanics during running, but current screening techniques are unreliable.

The NDCEE was tasked to determine the potential benefits of an automated foot assessor during basic training. The demonstration/validation was conducted from June 2007 to February 2008 at Fort Sam Houston and Lackland Air Force Base, TX, and involved 1000 service members. Following a comprehensive screening that utilized individual demographics, video recordings of gait, and biomechanical engineering, the team correlated foot arch height and total contact area to select appropriate footwear. The team also determined that the technology could help identify people at risk for overuse injuries of the lower extremities based on extreme foot pressures. The automated foot assessor system was effectively managed and operated by non-medical enlisted personnel as part of the demonstration.

In addition to demonstrating and validating the technology, the project team identified more than 35 DoD entities that would benefit from its use. In addition to Fort Sam Houston, the Army War College, Carlisle Barracks, PA, implemented the technology as a result of the NDCEE demonstration and is using it as part of their running shoe clinic.

CONTINUING DSOC INITIATIVES

Preventable mishaps impact force readiness and cost the DoD more than \$3 billion annually. When the Secretary of Defense set a 75 percent reduction goal in 2005, the DSOC was established to govern DoD-wide efforts to reduce preventable workplace and workforce mishaps at military installations, and the NDCEE is supporting this effort through the development, demonstration, validation, and implementation of a variety of initiatives.

Using a Web-based interface called Medevac, which pulls data from the DoD-wide Defense Safety Enterprise System (DSES), the NDCEE created a database that summarizes the causes and types of non-battle injuries (NBIs) that have required air evacuation from U.S. Central Command (CENTCOM) since 2001. NBIs are the leading diagnosis group for air evacuations from CENTCOM and account for one-third of all evacuations. Preliminary analysis confirms that the leading causes of NBIs for the USMC, Navy, and USAF combined are similar to those identified for the Army: sports/physical training, falls, and motor-vehicle related. Distribution of NBI cases differ by Service. This information provides the DoD with the ability to identify Service-specific causes of injury—a critical element of each Service's injury prevention program. Identification of high-frequency injury causes enables decision makers to target those causes as a basis for policies and programs to prevent injuries.

In addition to the potential healthcare implications for U.S. warfighters, this project has successfully shown that the Web-based Medevac interface greatly improved the efficiency of coding injury causes for air evacuation cases and also demonstrated the feasibility and utility of the DSES as a platform for injury analysis. Coding is complete for more than 5,000 cases that took place from 2001 through June 2007, and the NDCEE is working with the DSOC to identify additional applications for the Medevac interface.

The NDCEE also is supporting the DSOC's assault on noise exposure. Hearing loss is the most significant occupational health hazard in the DoD as well as in civilian industry. Over the past 30 years, hearing loss has accounted for more than \$1 billion in veteran's compensation claims, yet the significance of noise exposure on human performance, mission performance, and the long-term medical effects of hearing loss have not been consistently communicated to the acquisition community.



NDCEE investigations concluded that the NEAT can be used by the acquisition community to understand the life-cycle cost of hearing loss and identify recommendations for engineering controls that help mitigate noise. The American Tinnitus Association estimates that military disability payments for hearing loss will increase by 18 percent per year, totaling \$1.1 billion annually by 2011, based on an analysis of Veteran's Administration data.

The NDCEE demonstrated one tool that effectively supports the inclusion of noise control in the development of major acquisitions such as ships, aircraft, vehicles, and support equipment. In FY08, NDCEE team member Battelle developed the Noise Exposure and Acquisition Tool (NEAT), an Excel-based model to help the DoD acquisition program managers justify engineering controls that will prevent hearing loss. The NEAT models economic outcomes for varying levels and durations of long-term exposure to noise. It also estimates speech intelligibility loss due to noise exposure of a particular system, an important readiness issue. A draft of the NEAT tool and end user's guide were provided to the DSOC Acquisition and Technology Programs Task Force representatives as well as DoD noise experts. Their review concluded that NEAT is user-friendly and can be used by the acquisition community to understand the life-cycle cost of hearing loss and identify recommendations for engineering controls that help mitigate noise. The tool is expected to help validate the need to develop engineering controls and advanced hearing protection devices early in the acquisition process.

To address the ongoing drive to improve workplace health and safety through education and increased awareness—the DSOC Installation and Industrial Operations (IIO) Task Force sponsored an initiative to develop 14 stand-alone VPP and Safety and Occupational Health on-line modular training lessons, which have been delivered to each of the Services/government agencies for posting on their Service Branch Learning Management Systems (LMS). Subject matter experts from the Army, Navy, USMC, USAF, and the

DLA were instrumental in contributing to and reviewing and approving the course content.

The objective of the multi-media, Web-enabled courseware is to effectively train employees, managers, collateral duty safety officers, safety committee members, and supervisors via on-line technology to accurately identify workplace hazards, increase understanding of safety and health requirements, provide recommendations for eliminating/mitigating risk, and provide mentors to serve as facilitators for the implementation of VPP doctrine in the workplace. DoD Instruction 6055.1 requires such training be implemented. The ultimate goals are to help reduce accident and incident rates as well as establish an effective safety culture with zero tolerance.



Working with subject matter experts from the Army, Navy, USMC, USAF, and the DLA, the NDCEE developed 14 VPP and Safety and Occupational Health online training lessons. Comments from Service stakeholders included: "this is some of the best online training I've seen!!"



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The NDCEE is operated by: